NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

FISH PASSAGE

(Mi.)

CODE 396

DEFINITION

Modification or removal of barriers that restrict or impede movement or migration of fish or other aquatic organisms.

PURPOSE

Improve or provide upstream and downstream passage for fish and other aquatic organisms.

CONDITIONS WHERE PRACTICE APPLIES

All aquatic habitats where barriers impede passage for fish and other aquatic organisms. ***This practice shall be utilized in conjunction with the State Biologist. Sites proposed for this practice shall be evaluated by a multi-disciplined team consisting of persons trained in fisheries, aquatics, and/or wildlife biology; engineering and hydrology; fluvial geomorphology; and environmental compliance.***

This practice is usually installed as a component of (395) Stream Habitat Improvement and Management.

CRITERIA

Planning and Evaluation

All permits pertaining to the Clean Water Act (CWA) and other applicable laws shall be obtained prior to implementation of this practice.

Designs (including removal) of structures shall be based upon the multidiscipline evaluation as outlined above. The multidiscipline assessment will follow the guidance from appropriate sections of Part 654 of the National Engineering Handbook (NEH) including, but not limited to, Technical Supplement - 14N "Fish Passage and Screening Design"; and the "National Inventory and Assessment Procedure – For Identifying Barriers to Aquatic Organism Passage at Road and Stream Crossings.

A written analysis shall be performed to determine the need for identifying barriers to aquatic organism passage.

Sites planned for installation or removal of structures shall be evaluated for variations in stage and discharge, hydraulics, geomorphic impacts, sediment transport and continuity, and organic debris movement.

At a minimum hydrologic design criteria shall include the following information as applicable: velocities, depths, structural heights, attraction flows, structural lengths and pool volumes.

Plan and locate passage ***structures*** for compatibility with local site conditions and stream geomorphology, to the extent possible.

Avoid locations that will obstruct functions, increase harassment or predation, or result in excessive operation and maintenance requirements.

Minimize any foreseeable channel plan or profile shifts resulting from the modification or removal of a passage barrier. ***Refer to (395) Stream Habitat Improvement and Management where applicable.***

Replacing or removing an existing in-stream structure may trigger channel adjustments (i.e. aggradation, degradation) upstream and/or downstream of the work site. Grade controls or other slope

modifications shall be installed to mitigate adverse physical or ecological consequences where necessary (i.e. headcut). Refer to WV Conservation Practice Standards (584) Channel Stabilization, (410) Grade Stabilization Structure and (395) Stream Habitat Improvement and Management.

At a minimum biological design criteria shall include the following information: locomotive ability, water column preference, leaping ability, swimming speeds and local migration preference.

Projects shall be evaluated and designed to minimize and incorporate any effect on water management practices such as diversions, power generation or storage.

Removal of barriers (e.g. dams and low water crossings) and installation of structures shall be designed and implemented such that effects to wetlands, existing infrastructure and flooding are avoided or minimized.

Removal of barriers shall include a design to restore the original pattern, plan and profile of the stream channel to the extent practical.

Design Requirements

Designs shall be based on the applicable sections and supplements of the National Engineering Handbook including Technical Supplement - 14N "Fish Passage and Screening Design". Designs shall be based on the multidiscipline approach.

Placement of structures shall be designed and located to improve or provide passage for as many different aquatic species and age classes as possible and practicable.

Construction materials and methods shall be selected that are non-toxic, minimize adverse consequences to aquatic organisms, and are resistant to degradation.

Natural streambed materials shall be used over man-made surfaces when feasible.

Designs shall accommodate present and reasonably anticipated changes in watershed conditions.

At a minimum, structures shall be designed not to exceed known swimming and leaping capabilities of native species. Some native fish swimming speeds are provided in Table 1 of this standard. Contact the State Biologist for speeds and leaping abilities of other species if required. When feasible, hydraulic computations shall be utilized to document how designs satisfy the physiological requirements of target organisms.

Passage structures shall be evaluated and designed for hydraulic performance and structural integrity at the bankfull and 25-year peak flow events (at a minimum).

Passage features shall be designed to minimize or avoid energy deficits, physical stress, and harm to ***target, non-target and*** migratory organisms.

If screens are required, those designs will be written according to Part 654 of the NEH, Technical Supplement 14N.

If passage structures are installed, adequate attraction flow into a passage facility across the full range of discharge during which target species will move shall be provided.

Culvert Installation Design Criteria for Aquatic Life Passage

A multi-disciplined assessment procedure shall be utilized to determine the scope of the practice. Refer to Passage Through Crossing Assessment (National Inventory and Assessment Procedure – Nov. 2005)

The volume of fill for culverted structures is limited to the amount required to achieve transportation purposes.

Culverts shall be installed on the same slope as the streambed where practical.

Culverts shall completely span the bankfull channel.

The inlet/outlets must be designed in such a manner to maintain substrate in the bottom of the culvert (culverts installed in bedrock do not need to be countersunk). Countersinking the culvert in to the sub-pavement of the streambed or the use of a bottomless culvert (is preferred) and will satisfy this requirement.

If fills associated with the crossing extend into the floodplain, the use of floodplain culverts will be utilized where practical.

The use of baffles to reduce hydraulic force within the pipe will reduce flow capacity and make a culvert more prone to plugging. This method is not recommended.

CONSIDERATIONS

Consider removing a passage barrier before installing or retrofitting a new facility or structure. Complete or partial barrier removal usually provides better passage conditions, and is more economical than designing, constructing, operating, and maintaining many passage structures.

Consider any potentially negative interactions, including hybridization, disease, competition, or predation, between target and aquatic nuisance species when passage is provided above a barrier. If serious consequences are likely, take steps to minimize ***or avoid*** adverse effects.

Consider the habitat requirements of other aquatic or terrestrial species that may be affected by a passage project. Some passage facilities may improve survival for terrestrial vertebrates by providing safe migration routes under roadways.

Consider the amount of habitat upstream and downstream of a barrier to evaluate into project feasibility, cost effectiveness, and/or potential for connecting fragmented habitats. Using a watershed approach whenever possible provides a framework for project planning.

Fish passage facilities are often associated with water diversions or intakes that injure or kill aquatic species. Prevent fish entrainment, particularly juveniles, into diversions, penstocks, or pumps by installing screens.

Consider upstream and larger watershed issues that may affect passage. Common solutions may include maintaining or restoring adequate instream flow and/or other water quality parameters (e.g., temperature, dissolved oxygen).

Floodplain and water development often alter historic river channel pattern and location. Consider bypassing a barrier by restoring streamflow to former, stable natural channels.

Passage facilities can assist population recovery and management. Where applicable, consider local, state, or federal brood stock collection and species management initiatives when planning passage features.

In the case of low-water crossings, water quality impacts from vehicular pollutants and erosion caused by tire action can be severe. Where possible, reroute roadways or install hardened instream crossings.

Consider the involvement of local non-governmental organizations such as Trout Unlimited, etc.

PLANS AND SPECIFICATIONS

Provide site-specific plans for this practice ***(job sheets, designs and other approved documentation)***. Plans will specify passage structure design, layout, and overall objectives.

Unless approved by the State Biologist, the watershed and/or stream conditions shall be documented by an appropriate method which contains the following information:

- ***A complete site assessment (e.g. <u>Passage Through Crossing Assessment</u> (National Inventory and Assessment Procedure – Nov. 2005). [This methodology will satisfy the assessment described below in a-]***

  a) Location map and plan view of site(s);

  b) Target species

  c) Barrier type

  d) Biological assessment, general biologic design criteria, hydrologic analysis, existing conditions and environmental concerns. All alternatives, plans, designs and specifications which include:

  - Detailed construction drawings showing site elevations (including headwater and tailwater fluctuations), description and analyses of design flows, and structural operating criteria; Construction specifications describing materials, logistics

(including erosion control), and timing. Guidance for post-construction evaluation and monitoring to assess structural integrity and compliance with design criteria ***(if applicable).***

e) WV NRCS CPA-052 or similar environmental evaluation documentation including any required permits. Permit conditions shall be incorporated into construction designs, implementation schedules and any component practices.

f) Any practices necessary to carryout the intended function and design of this practice and all activities associated with those practices.

g) Operation and Maintenance Plan

OPERATION AND MAINTENANCE

Develop an operation and maintenance plan for all applications of this standard. Within the plan, provide for periodic inspection and corrective action should passage conditions become impaired because a structure is damaged or inoperable. Typical operation and maintenance items include:

- Responsible entity for the daily operation and maintenance of a passage structure (if applicable).
- Inspection schedule of structures to ensure it is operating within design criteria and the regular removal of debris accumulations.
- Adjust gates, orifices, valves, or other control devices as needed to regulate flow and maintain a passage structure within operating criteria.
- Periodically check staff gages or other flow metering devices for accuracy.
- Annually inspect passage structures for structural integrity and disrepair.
- Inspect gate and valve seals for damage.
- Replace worn or broken stoplogs, baffles, fins, or other structural components.
- Remove sediment accumulations from within passage structure where applicable.

**** Bold italics indicate information added to the national standard by West Virginia.***

REFERENCES

Nationwide Permits for the State of West Virginia. 2007. Aquatic Life Passage Standard Condition for Culvert Installation. (K.Krantz, WVDNR)

Aquatic Nuisance Species Information. 2006. (per Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 [16 U.S.C. 4701]).

Bell, M.C. 1990. *Fisheries Handbook of Engineering Requirements and Biological Criteria.* United States Army Corps of Engineers, Fish Passage Development and Evaluation Program, Portland, OR. 290 p.

Clay, C.H. 1995. *Design of Fishways and Other Fish Facilities*. Second Edition. CRC Press, Inc. Boca Raton, FL. 248 pp.

Jungwirth, M., S. Schmutz, and S. Weiss, editors. 1998. *Fish Migration and Fish Bypasses.* Fishing News Books, Oxford, UK. 438 pp.

Lang, M., M. Love, and W. Trush. 2004. Improving fish passage at road crossings. Final report to the National Marine Fisheries Service, produced in cooperation with Humboldt State University Foundation under NMFS contract 50ABNF800082. Arcata, CA. 128 pp.

NRCS. 2006. Fish passage and screening designs. Technical Supplement 14-N to NEH-654 – Stream Restoration Design Handbook.

Taylor, R.N. and M. Love. 2003. Fish passage evaluation at stream crossings. Part IX *in:* California Stream Habitat Restoration Manual, 3rd edition, 1998. Prepared by G. Flosi, S. Downie, J. Hopelain, M. Bird, R. Coey, and B. Collins. Sacramento, CA. 100 electronic pp.

Washington Department of Fish and Wildlife (WDFW). 2000. Fishway guidelines for Washington State. Olympia, WA. 57 pp.

WDFW. 2000. Fish passage barrier and surface water diversion screening and prioritization manual. WDFW Habitat Program, Environmental Restoration Division, Salmon Screening, Habitat Enhancement and Restoration Section, Olympia, WA. 158 pp.

WDFW. 2003. Design of road culverts for fish passage. Olympia, WA. 110 pp.

ADAMS SR, HOOVER JJ, KILLGORE KJ (2000) Swimming Performance of the Topeka Shiner (*Notropis topeka*) an Endangered Midwestern Minnow. The American Midland Naturalist: Vol. 144, No. 1 pp. 178–186

National Inventory and Assessment Procedure – For Identifying Barriers to Aquatic Organism Passage at Road-Stream Crossings, November 2005

Table 1. Selected Fish Swimming Speeds

Highlighted Fish Swimming Speeds							
Selected Non Salmonid Fish Species		*SWIMMING SPEEDS feet/second*					*References*
			Adult		Juvenile		
Common Name	Scientific Name	Cruising	Sustained	Darting	Sustained	Darting	
Quilback	*Carpiodes cyprinus*	0 to 3	3 to 5	5 to 10			Bell, Fisheries Handbook, Pg. 6.3 (for Suckers in general)
River carpsucker	*Carpiodes carpio*	0 to 3	3 to 5	5 to 10			Bell, Fisheries Handbook, Pg. 6.3 (for Suckers in general)
Highfin carpsucker	*Carpiodes velifer*	0 to 3	3 to 5	5 to 10			Bell, Fisheries Handbook, Pg. 6.3 (for Suckers in general)
White sucker	*Catostomus commersoni*	0 to 3	3 to 5	5 to 10			Bell, Fisheries Handbook, Pg. 6.3 (for Suckers in general)
White sucker (7"-16")	*Catostomus commersoni*	0 to 3	3 to 5	5 to 10	1 to 3.5		Bell, Fisheries Handbook, Pg. 6.3 (for Suckers in general)
Northern hog sucker	*Hypentelium nigricans*	0 to 3	3 to 5	5 to 10			Bell, Fisheries Handbook, Pg. 6.3 (for Suckers in general)
River redhorse*	*Moxostoma carinatum*	0 to 3	3 to 5	5 to 10			Bell, Fisheries Handbook, Pg. 6.3 (for Suckers in general)
Greater redhorse**	*Moxostoma valenceinnesi*	0 to 3	3 to 5	5 to 10			Bell, Fisheries Handbook, Pg. 6.3 (for Suckers in general)
Shorthead redhorse	*Moxostoma macrolepidotum*	0 to 3	3 to 5	5 to 10			Bell, Fisheries Handbook, Pg. 6.3 (for Suckers in general)
Golden redhorse	*Moxostoma erythrurum*	0 to 3	3 to 5	5 to 10			Bell, Fisheries Handbook, Pg. 6.3 (for Suckers in general)
Silver redhorse	*Moxostoma anisurum*	0 to 3	3 to 5	5 to 10			Bell, Fisheries Handbook, Pg. 6.3 (for Suckers in general)
Goldfish	*Carassius auratus*		1 to 3.5	3.5 to 6	1 to 2		Bell, Fisheries Handbook, Pg. 6.5
Trout Perch	*Percopsis omiscmaycus*			3	1.5 to 2		Bell, Fisheries Handbook, Pg. 6.5
Emerald shiner (2.5")	*Notropis atherinoides*			4	1 to 3.5		Bell, Fisheries Handbook, Pg. 6.5
Green Sunfish	*Lepomis cyanellus*			6 to 10			Webb 1975
Bluegill Sunfish	*Lepomis machrochirus*			2.5 to 4.3			Webb 1978a
Crappie	*Pomoxis annularis*			1.1			
Yellow Walleye (9-16")	*Stizostedion vitreum*				1 to 3		Bell, Fisheries Handbook, Pg. 6.5
Smallmouth Bass	*Micropterus dolomieu*						Bell, Fisheries Handbook, Pg. 6.5
Channel Catfish	*Ictalurus punctatus*		1.5				Waterpaugh and Bettinger, 1985
Largemouth Bass	*Micropterus salmoides*						Webb 1986b
Muskellunge	*Essox spp.*			3			
Pike (14")	*Essox lucius*			11	1 to 4	4 to 8	Bell, Fisheries Handbook, Pg. 6.5
Pike (15")	*Essox lucius*			13			Harper and Blake 1991
Flathead minnow (2.5")	*Pimepales promelas*			2.6			Webb 1986b
Yellow Perch (6")	*Perca flavenscens*			3.7			Webb 1978a
Longnose sucker (4-16")	*Catostomus catostomus*			7	1 to 3		Bell, Fisheries Handbook, Pg. 6.5
Goldeye (9")	*Hiodon alosoides*			4	1 to 2.5		Bell, Fisheries Handbook, Pg. 6.5